Workshop “AUTOSAR Variant Management in PREEvision 9.0”

PREEvision User Day 2019
Agenda

- **Introduction and Overview**
  - Variant Management Challenges
  - AUTOSAR Variant Management Concepts
  - Summary
Introduction and Overview

Introduction of Participants and Expectations

To my person:
  > Jörg Schäuffele
  > Product Manager for PREEvision
  > Overall Strategy, Variant Management, Logical Architecture
  > At Vector since 2007

Short introduction round:
  > Name, company, background
  > Ethernet / SOA use cases, actual - planed
  > Knowledge, experience in that field
  > Expectations for the workshop

Goals and Focus of the workshop (50 min):
  > Short introduction and expectations (10 min)
  > Flyover the variant management process (30 min)
  > Questions & Answers (10 min)
  > And last but not least: Get Together of the PREEvision Variant Management community
Introduction and Overview

Product Line in PREEvision

Automotive Standards
- Supported by Import- and Export Interfaces
  - ReqIF
  - AUTOSAR Classic
  - AUTOSAR Adaptive
  - KBL
  - VEC

PREEvision Product Line
- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Communication
  - Abstraction
  - Reuse and Variants
  - Decomposition
Introduction and Overview

Reuse in PREEvision

PREEvision Product Line 1
- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness

PREEvision Product Line 2
- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness

Reusable Artifact
Reuse of Assets in PREEvision

PREEvision Product Line 1

- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness

PREEvision Product Line 2

- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness

Reusable Artifact: Red
Asset: Blue
Reuse Assets
Introduction and Overview

Library or Building Set or Platform Strategies

Library/Building Set/Platform

- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness

Derive

Compact Class Cars

- Requirements
- Logical Function Architecture
- Software/Service Architecture
- Hardware Architecture
- Wiring Harness

Luxury Class Cars

Middle Class Cars

Requirements

Communication

Vector
Variants in PREEvision

Introduction and Overview

An artifact (function, system, HW component, SW component, ...) developed in a building set approach has to consider and fulfill the needs of different variants:
Agenda

Introduction and Overview

- Variant Management Challenges
  - AUTOSAR Variant Management Concepts
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Challenges

- How to define Commonalities and Differences, how to define Variants?
- A seamless Variant Management Approach is needed!
  - ... from early Design and Requirements Engineering to late Production and Service Steps
  - ... from the System Design at the OEM to the Component and Software Design at the Supplier
- The approach is used by different roles:
  - Requirements and Test Engineering
  - Function and System Design
  - Software Design
  - Component Design
  - Wiring Harness Design
- A standard is needed and can help!
  - AUTOSAR Variant Management

- The approach shall be easy to learn and understand and comfortably supported by all involved engineering tools!
Agenda

Introduction and Overview
Variant Management Challenges

- AUTOSAR Variant Management Concepts
Summary
Pre Build and Post Build Variant Management Concepts

AUTOSAR Variant Management Concepts

Pre Build and Post Build Variant Management Concepts

Development

System Design Time
Code Generation Time
Pre Compile Time
Link Time

Pre Compiler Statements:
"#if ... #else ... #endif"

Production
Build

Pre Build

Post Build

Post Build Concepts: PostBuildSelectable/PostBuildLoadable supported by AUTOSAR Base Software

Service

Coding
Flash Programming

PREEvision supports AUTOSAR System Description Concepts for Variant Management:

- System Constants
- System Constants Values and Value Sets
- Pre Build Variant Conditions (dependent on System Constants)
- Post Build Variant Criterions
- Post Build Variant Criterion Values and Value Sets
- Post Build Variant Conditions (dependent on Post Build Variant Criterions)
A simple Example

**Software Architecture**

**Hardware Architecture and Mappings**
### System Constants and Post Build Variant Criteria

#### System Constants: System Constant Editor

<table>
<thead>
<tr>
<th>System Constant Value Set</th>
<th>Values</th>
<th>NumberCylinders</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Engine ValueSet / -: (System</td>
<td>2.000</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Gasoline Engine ValueSet / -: (System</td>
<td>2.000</td>
<td>-</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Post Build Variant Criteria: Post Build Variant Criterion Editor

<table>
<thead>
<tr>
<th>Post Build Variant Criterion Value Set</th>
<th>Post Build Variant Criterion Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR5 ValueSet / -: (Post Build ...</td>
<td>EUR5</td>
</tr>
<tr>
<td>EUR6 ValueSet / -: (Post Build ...</td>
<td>EUR6</td>
</tr>
</tbody>
</table>

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[Diagram of system components and variant criteria]
AUTOSAR Variant Management Concepts

Variation Points

- Take only care for the differences, not for the commonalities!
- Define Variation Points using
  - Variation Point Sets and
  - Pre Build and Post Build Variant Conditions
Variation Points

- Take only care for the differences, not for the commonalities!
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AUTOSAR Variant Management Concepts

Predefined Variants

- Define Predefined Variants by
  - assigning Value Sets
  - assigning other Predefined Variants

- Gasoline Engine
- Diesel Engine
AUTOSAR Variant Management Concepts

**Variant Activation**

- Calculate Variant, Activate Variant and check Variant Content by Highlighting

**Software Architecture**

**Hardware Architecture and Mappings**

Here is something wrong!
Feature Models

- There are dependencies and constraints between the vehicle features:
  - Example: Diesel excludes Gasoline, Gasoline excludes Diesel
  - AUTOSAR supports Feature Models to express these dependencies:

- Exchanging Feature Models with other tools is possible via AUTOSAR Import and Export.
Feature Selection Sets

- Feature Selections can be defined using Alternatives in PREEvision
- Alternatives only allow Feature Selections saturating the Feature Model
- Example:
AUTOSAR Variant Management Concepts

Feature Map

- Feature Selections are mapped to Predefined Variants with Feature Maps.
- 1:1 Mappings “Feature – ValueSet” and more complex Mappings possible!
- More complex Mappings often needed to de-couple Solution and Problem Domain!
- Example:
All these concepts are
- supported for all layers
- not limited to AUTOSAR SW and Communication

- Select what you need
- Use „out of the box“
Agenda

Introduction and Overview
Variant Management Challenges
AUTOSAR Variant Management Concepts

Summary
Product Lines, Reuses, and Variants in PREEvision

- Product Line Data Model
  - inspired by Automotive Standards
- Reuse Concepts
  - supporting Building Set Strategies
- Variant Management
  - following the AUTOSAR Standard
- Team Collaboration Platform
  - Proven in use for many Years
- Graphical User Interface
  - easy to understand
  - dedicated support for different Roles
For more information about Vector and our products please visit

www.vector.com

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